Dynamic Stability and Bifurcation in Nonconservative Mechanics

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Abstrak

The book offers a unified view on classical results and recent advances in the dynamics of nonconservative systems. The theoretical fundamentals are presented systematically and include: Lagrangian and Hamiltonian formalism, non-holonomic constraints, Lyapunov stability theory, Krein theory of spectra of Hamiltonian systems and modes of negative and positive energy, anomalous Doppler effect, reversible systems, sensitivity analysis of non-self-adjoint operators, dissipation-induced instabilities, local and global instabilities. They are applied to engineering situations such as the coupled mode flutter of wings, flags and pipes, flutter in granular materials, piezoelectric mechanical metamaterials, wave dynamics of infinitely long structures, radiative damping, stability of high-speed trains, experimental realization of follower forces, soft-robot locomotion, wave energy converters, friction-induced instabilities, brake squeal, non-holonomic sailing, dynamics of moving continua, and stability of bicycles and walking robots.
The book responds to a demand in the modern theory of nonconservative systems coming from the growing number of scientific and engineering disciplines including physics, fluid and solids mechanics, fluid-structure interactions, and modern multidisciplinary research areas such as biomechanics, micro- and nanomechanics, optomechanics, robotics, and material science. It is targeted at both young and experienced researchers and engineers working in fields associated with the dynamics of structures and materials. The book will help to get a comprehensive and systematic knowledge on the stability, bifurcations and dynamics of nonconservative systems and establish links between approaches and methods developed in different areas of mechanics and physics and modern applied mathematics.